

**FLEXIBLE AMINOPLAST-CURABLE FILM-FORMING COMPOSITIONS AND COMPOSITE COATING**

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**Abstract**

A flexible, aminoplast-curable film-forming composition can serve as a transparent coating composition for a multi-component composite coating composition having the transparent coating on a pigmented or colored base coat. The film-forming composition comprises at least two polymeric components. One is a polyether polymer containing a plurality of terminal and/or pendant carbamate groups of Structure (I). Another is at least one additional carbamate functional polymer along with urethane oligomer or is a polyurethane polyol or is a polyester derived from cycloaliphatic acid or anhydride. The former include carbamate functional polyester, acrylic polymer, and polyurethane, where each contains a plurality of terminal and/or pendant carbamate groups of Structure (I) depicted above. Also the urethane oligomers have a plurality of carbamate groups of Structure (I) that are pendant and/or terminal. The latter polyurethane polyol has a plurality of pendant and/or terminal hydroxyl groups and optionally can be used with the urethane polyol and/or any of the aforementioned carbamate functional polymers. Optionally an additional polymer that is present in an acrylic polymer containing a plurality of amide groups with or without a plurality of terminal and/or pendant carbamate groups of Structure (I). Also with the presence of the amide functional acrylic polymer, silica can be employed. Additionally for cross-linking the film-forming composition contains an aminoplast cross-linking agent.

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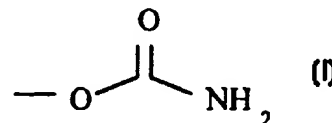
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(21) International Application Number: PCT/US97/00797 (22) International Filing Date: 15 January 1997 (15.01.97)  (30) Priority Data: 08/586,053      16 January 1996 (16.01.96)      US 08/770,195      19 December 1996 (19.12.96)      US  (71) Applicant: PPG INDUSTRIES, INC. [US/US]; One PPG Place, Pittsburgh, PA 15272 (US).  (72) Inventors: BARANCYK, Steven, V.; 1826 Front Street, Pittsburgh, PA 15215 (US). VERARDI, Christopher, A.; 2156 Poor Richard's Lane, Pittsburgh, PA 15237 (US). HUMPHREY, William, A.; 193 Vetter Drive, Pittsburgh, PA 15235 (US). TERRAGO, Gina, M.; 4021 Wick Place, Wexford, PA 15090 (US).  (74) Agents: STACHEL, Kenneth, J.; PPG Industries, Inc., One PPG Place, Pittsburgh, PA 15272 (US) et al.			(81) Designated States: AU, BR, CA, CN, FI, HU, JP, KR, MX, NZ, PL, RU, SK, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published <i>With international search report.          Before the expiration of the time limit for amending the          claims and to be republished in the event of the receipt of          amendments.</i>
(54) Title: FLEXIBLE AMINOPLAST-CURABLE FILM-FORMING COMPOSITIONS AND COMPOSITE COATING  (57) Abstract  <p>A flexible, aminoplast-curable film-forming composition can serve as a transparent coating composition for a multi-component composite coating composition having the transparent coating on a pigmented or colored base coat. The film-forming composition comprises at least two polymeric components. One is a polyether polymer containing a plurality of terminal and/or pendant carbamate groups of Structure (I). Another is at least one additional carbamate functional polymer along with urethane oligomer or is a polyurethane polyol or is a polyester derived from cycloaliphatic acid or anhydride. The former include carbamate functional polyester, acrylic polymer, and polyurethane, where each contains a plurality of terminal and/or pendant carbamate groups of Structure (I) depicted above. Also the urethane oligomers have a plurality of carbamate groups of Structure (I) that are pendant and/or terminal. The latter polyurethane polyol has a plurality of pendant and/or terminal hydroxyl groups and optionally can be used with the urethane polyol and/or any of the aforementioned carbamate functional polymers. Optionally an additional polymer that is present in an acrylic polymer containing a plurality of amide groups with or without a plurality of terminal and/or pendant carbamate groups of Structure (I). Also with the presence of the amide functional acrylic polymer, silica can be employed. Additionally for cross-linking the film-forming composition contains an aminoplast cross-linking agent.</p>			



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COMPOSITIONS AND COMPOSITE COATING**

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**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation-in-part of U.S. Patent Application Serial No. 08/586,053, filed on January 16, 1996, which is a continuation-in-part of U.S. Patent Application  
10 Serial No. 08/236,912, filed on April 29, 1994, now abandoned. Reference is made to related U.S. Patent Application Serial Nos. 08/605,420 filed February 22, 1996; 08/494,905 filed on June 26, 1995, 08/345,912 filed on November 28, 1994, 08/329,915 filed on October 27, 1994, 08/320,793 filed on  
15 October 7, 1994, and 07/968,807 filed on October 30, 1992.

**FIELD OF THE INVENTION**

The present invention relates to flexible, aminoplast-curable film-forming compositions and a multi-component  
20 composite coating composition comprising a pigmented or colored base coat and a transparent or clear coat.

**BACKGROUND OF THE INVENTION**

Plastic substrates are commonly used in automotive parts  
25 and accessories. Organic coating compositions are very often applied to these substrates for decorative and protective purposes. These plastic substrates are made of a variety of flexible thermosetting and thermoplastic materials such as polyethylene and polypropylene, thermoplastic urethane,  
30 polycarbonate, thermosetting sheet molding compound, reaction-injection molding compound, acrylonitrile-based materials, nylon and the like. The coating compositions that are used on these substrates must also be flexible so as to avoid cracking and adhesive failure under normal stresses and torsional  
35 forces to which the substrates may be subjected.

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Color-plus-clear coating systems involving the application of a colored or pigmented base coat to a substrate followed by the application of a transparent or clear topcoat to the base coat have become very popular as original finishes  
5 for automobiles. The color-plus-clear systems have outstanding gloss and distinctness of image and the clear coat is particularly important for these properties.

Coating systems of the prior art which are known to be resistant to acid etch include acid-epoxy curable compositions  
10 such as those disclosed in U.S. Patent No. 4,681,811 and compositions containing hydroxyl functional polymers reacted with isocyanates or polyisocyanates to form polyurethanes. The isocyanates are expensive and the toxicity of the isocyanates is an additional drawback.

15 Coating systems that employ hydroxy-aminoplast cure mechanisms are well known in coating technology and provide many excellent coating properties. They are inexpensive, durable and attractive. However, it is widely recognized that such coatings, particularly clear coats, have poor resistance  
20 to etching by acid. Acid etch resistance in coatings is becoming an increasingly desirable property, particularly for automotive coatings. Aminoplast cured coating systems of the prior art are not highly effective for providing protection against etching caused by acid rain. Additionally, such  
25 coating systems are often "high solids" coating compositions which tend to sag upon application to vertical surfaces and during baking. Such sagging adversely affects the appearance properties of the coating compositions.

It is desirable to provide a coating composition having  
30 improved appearance and performance properties, such as sag and acid etch resistance, utilizing inexpensive aminoplast

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